

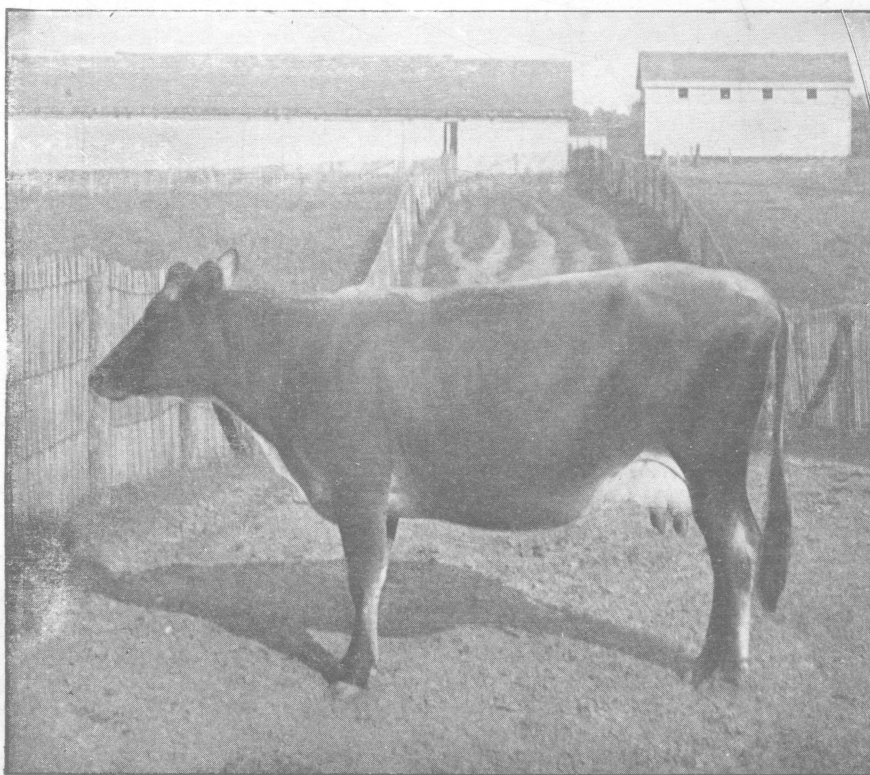
SILAGE *vs.* GRAIN FOR DAIRY COWS.

CAN SILAGE BE MADE TO TAKE THE PLACE OF A LARGE PORTION OF  
THE CONCENTRATES OF THE RATION?

OHIO  
Agricultural Experiment  
Station.

WOOSTER, OHIO, U. S. A., OCTOBER, 1904.

BULLETIN 155.



TEENY'S 4th.

Milk, 5 881.9 pounds. Butter fat 362 4658 pounds. Average per cent fat 6.16. Value of products \$104.66. Cost of feed for a year \$39.92. Lactation period 340 days.

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*EXPERIMENT STATION, Wooster, Ohio.*

ORGANIZATION OF THE  
OHIO AGRICULTURAL EXPERIMENT STATION.

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The Bulletins of this Station are issued at irregular intervals. They are paged consecutively and an index is included with the Annual Report, which constitute the final number of each yearly volume.

# BULLETIN

OF THE

## Ohio Agricultural Experiment Station

NUMBER 155.

OCTOBER, 1904.

### SILAGE *vs.* GRAIN FOR DAIRY COWS.

BY C. G. WILLIAMS.

During the winter and spring of 1904 this Station conducted an experiment to determine what effect the feeding of more silage than is usually fed by dairymen, with a corresponding reduction in the grain portion of the ration, might have upon the production of milk, butter fat, gain in live weight, cost of the ration and consequent profit.

In other words, can silage be made to take the place of a considerable portion of the grain usually fed to dairy cows?

The silage used in this test was a mixture of one ton of soy beans and cowpeas to two and one-half tons of silage corn. There were nearly twice as many soy beans in the mixture as cowpeas. The silage corn was very low in dry matter, owing to an unfavorable season. It is not uncommon that silage corn alone will test as high, and even higher, in dry matter, and crude protein, as well, than did this mixed silage.

The chemist of the Station, Prof. Ames, found these feeds, as put into the silo, to analyze as follows:

TABLE I.—PERCENTAGE COMPOSITION OF GREEN FEEDS.

| FEED                            | Dry matter. | Ash.  | Protein. | Crude fiber. | Nitrogen-free extract. | Ether extract. |
|---------------------------------|-------------|-------|----------|--------------|------------------------|----------------|
| Silage corn . . . . .           | 16.34       | 0.942 | 1.792    | 4.224        | 8.967                  | 0.415          |
| Soy beans . . . . .             | 28.54       | 2.115 | 4.731    | 7.860        | 11.532                 | 2.303          |
| Cow peas . . . . .              | 16.93       | 2.380 | 2.199    | 3.570        | 8.221                  | 0.560          |
| Total contents of silo. . . . . | 18.63       | 1.298 | 2.363    | 4.680        | 9.363                  | 0.915          |

From the low content of dry matter it is evident that there was little grain in the corn.

The general plan of the experiment was to compare two rations which should carry as nearly as possible the same amount of dry matter and nutrients. In one ration these nutrients were to be derived largely from roughage—mainly silage; in the other ration no silage was to be fed, and as little roughage as seemed wise, the bulk of the nutrients being derived from concentrates. In the silage ration over 82 per cent. of the total dry matter was derived from roughage; in the “grain” ration less than 43 per cent. was derived from roughage.

Eight cows were gradually put upon these rations during the month of December, 1903, the change beginning December 9th. Prior to this date they had about 30 pounds of silage, 5 pounds of corn meal, 5 pounds of bran and 8 to 10 pounds of stover per day. The experiment began January 1, 1904. Five of the cows continued in the test until its completion, April 30, 1904. Three dropped out and two others, which freshened in January, were entered in the test in February and March.

TABLE II—THE COWS USED IN THE TEST.

| NAME OF<br>COW        | Breed       | Age at<br>beginning of<br>test. | Date<br>of last<br>calf. | Pounds of milk and butter fat<br>given the month before, or<br>first month of test |               |
|-----------------------|-------------|---------------------------------|--------------------------|------------------------------------------------------------------------------------|---------------|
|                       |             |                                 |                          | Milk                                                                               | Fat           |
| I —IN SILAGE RATION:— |             |                                 |                          |                                                                                    |               |
| Vanity's 2nd          | Angus       | 8 yrs 4 mos                     | July 4 1903              | 433 5                                                                              | 18 64         |
| Teen's 4th            | Jersey      | 6 yrs 5 mos                     | July 25 1903             | 459 7                                                                              | 27 90         |
| Star's 2nd            | G Shorthorn | 6 yrs 11 mos                    | Nov. 4 1903              | 552 0                                                                              | 24 84         |
| Patti's 5th           | Red Polled  | 4 yrs 10 mos                    | Dec 9, 1903              | 876 8                                                                              | 38 14         |
| May's 2nd             | Jersey      | 7 yrs 7 mos                     | Jan 9 1904               | 690 1                                                                              | 41 40         |
| Average               |             | 6 yrs 10 mos                    | Oct. 10 1903             | 40 per day                                                                         | 1 006 per day |
| II:—IN GRAIN RATION:— |             |                                 |                          |                                                                                    |               |
| Nervilette's 4th      | Jersey      | 6 yrs                           | June 2, 1903             | 351 8                                                                              | 19 52         |
| Phillips' 4th         | G. Guernsey | 5 yrs 4 mos                     | Aug 29, 1903             | 4 9 4                                                                              | 22 72         |
| Nelly's 4th           | Red Polled  | 6 yrs, 6 mos                    | Nov 22, 1903             | 7 7 5                                                                              | 34 44         |
| Fancy's 4th           | Angus       | 5 yrs 11 mos                    | June 25, 1903            | 370 9                                                                              | 15 95         |
| Miami Pride           | Guernsey    | 6 yrs 8 mos                     | Jan 31 1904              | 871 0                                                                              | 47 07         |
| Average               |             | 6 yrs 1 mo                      | Sept 16, 1903            | 18 3 per day                                                                       | 0 93 per day  |

The cows used were not ideal dairy cows by any means. Some of them are very good ones; others could hardly be classed as dairy cows. One object of the experiment was to test the effect of the rations used upon different types of cows. At the time the selections were made it was thought that the groups were as nearly equal as could well be arranged.



## THE RATIONS.

The rations actually consumed differ slightly from the plan for each lot of cows. Those taking the grain ration did not eat as much cut stover as was planned. Nor did all take the full sixty pounds of silage. In no instance did any of the silage-fed cows get off their feed, but sixty pounds per day was a little more than two of the cows cared for.

The average daily ration actually consumed, as shown by dividing the total feed consumed by the number of days of feeding, is as follows:

TABLE III.—AVERAGE DAILY RATIONS.

| Lbs.               | FEED            | Dry matter.<br>Lbs. | Protein.<br>Lbs. | Crude fiber<br>Lbs. | Nitrogen-free<br>extract.<br>Lbs. | Ether<br>extract.<br>Lbs. |
|--------------------|-----------------|---------------------|------------------|---------------------|-----------------------------------|---------------------------|
| I:—SILAGE RATION:  |                 |                     |                  |                     |                                   |                           |
| 58                 | Silage .....    | 10 83               | 1 369            | 2 71                | 5.43                              | .531                      |
| 6 8                | Mixed hay ..... | 5 77                | 0 550            | 1.90                | 2 761                             | .211                      |
| 2                  | Oil meal.....   | 1.80                | 0 664            | 0 19                | 0 768                             | .06                       |
| 2.                 | Bran .....      | 1.76                | 0 309            | 0 18                | 1 073                             | .08                       |
|                    | Total .....     | 20 16               | 2 891            | 4 98                | 10 037                            | .882                      |
| II:—GRAIN RATION:— |                 |                     |                  |                     |                                   |                           |
| 4 7                | Stover .....    | 3 29                | 0.211            | 1 15                | 1.70                              | .063                      |
| 6 4                | Mixed hay ..... | 5.43                | 0 518            | 1.79                | 2.60                              | .198                      |
| 2.5                | Oil meal .....  | 2.25                | 0 83             | 0 237               | 0 96                              | .075                      |
| 5.                 | Corn meal ..... | 4.25                | 0 46             | 0.095               | 3.435                             | .19                       |
| 6.                 | Bran ...        | 5 29                | 0 924            | 0 54                | 3 234                             | .24                       |
|                    | Total.....      | 20.51               | 2.943            | 3.812               | 11.929                            | .766                      |

It has been thought best, in giving the composition of rations and the analysis of feeds, to use our own determinations of the feeds in question, where we have made them, and where we have not, to use the Jenkins and Winton table as given in Bulletin 11, of the Office of Experiment Stations, U. S. Department of Agriculture.

The total composition is given in Table III rather than the "digestible nutrients" for two reasons: There is less of guesswork in the former; and under our new feed law in this state purchasers of feeds will become familiar with the total constituents rather than the digestible, and likely less confusion will result.

The amount of dry matter consumed is lower than is usually recommended. It is possible that more might have been fed with advantage. However, it will be noted later that the production of milk is quite satisfactory, and is accompanied by gain in live weight. It would appear then that this production was not at the expense of carcass.

While the total nutrients in the two rations are quite similar, results of digestion experiments in this country and in Europe would lead us to expect that the grain ration would furnish somewhat more digestible nutrients than the silage ration.

It perhaps need not be stated that all the food and water given the cows during the test was carefully weighed to them, and the difference between these weights and the weight of any portion rejected was charged to the cow.

#### THE VALUATION OF FEED AND PRODUCTS.

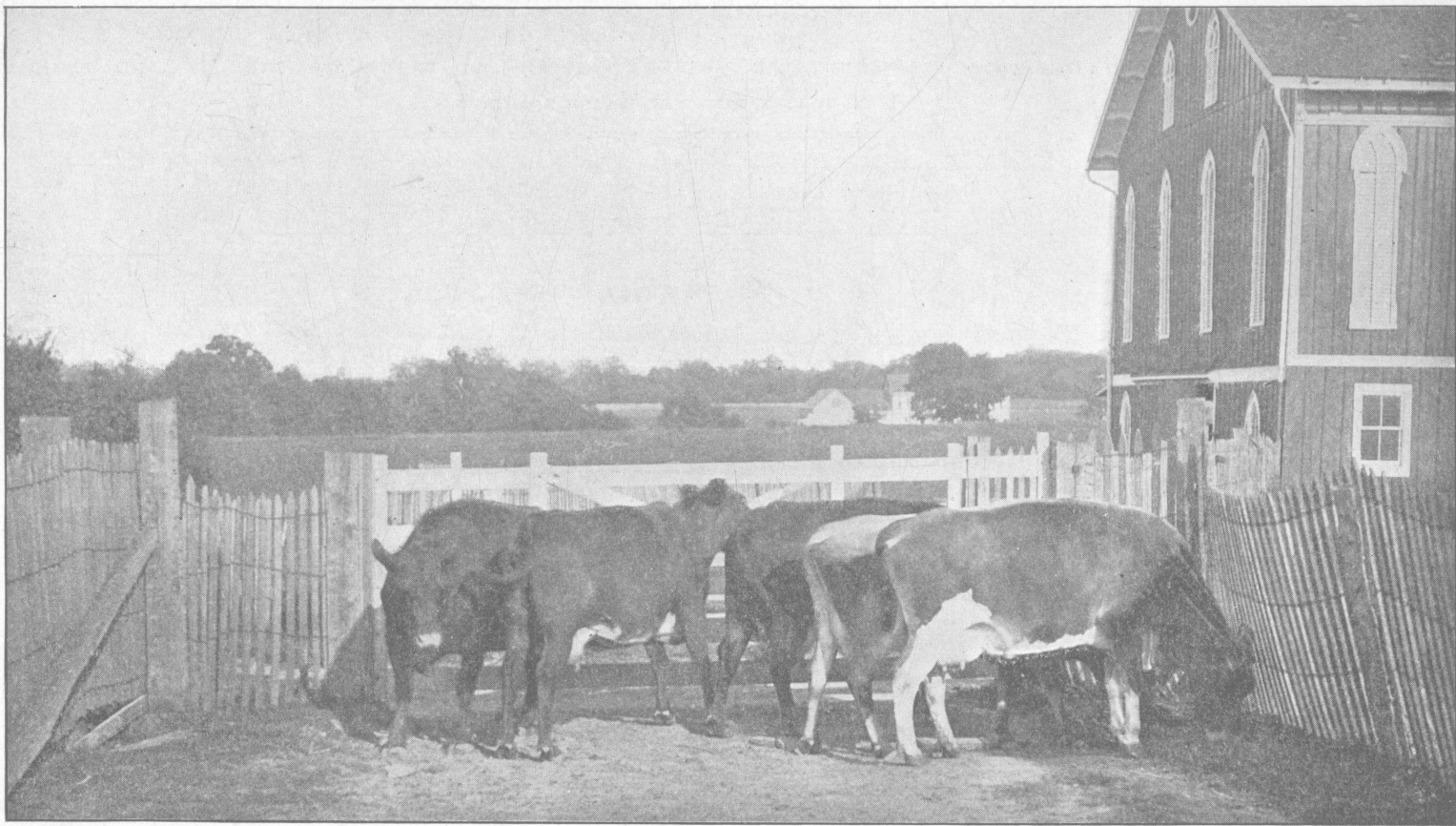
In the Station's account with its dairy herd it is the custom to value the feed consumed and butter fat produced at the market quotation for the month in question. This for feeds grown by the Station. When the feed is purchased it is charged to the cows at its cost to the Station, f. o. b. Wooster. The cost of feeds like corn silage and stover, which do not figure in the markets, is gotten at in other ways. The value placed upon a ton of silage is based upon that of the corn and stover grown upon similar ground and marketed as such. For instance: Upon ground on which we average fifty bushels of shelled corn per acre we grow fifteen tons or better of silage corn. The fifteen tons of silage corn therefore may be said to be worth the market value of the fifty bushels of corn, plus the one and one-fourth ton of stover which will go with it. (We find the expense of putting an acre of corn into the silo to be practically the same as shocking, husking and cribbing the grain and hauling off the stover.) We have here charged 51 cents per bushel for corn on the average for the period covered by the test and \$4.00 per ton for stover. This will make the acre of silage corn worth \$30.50, or \$2 03 per ton.

The price credited for butter fat is based upon the wholesale price of Elgin butter, as quoted in current publications. The customary one-sixth is added to the fat for the butter equivalent.

#### SCHEDULE OF PRICES.

|                 |                      |
|-----------------|----------------------|
| Silage.....     | 10 cents per cwt.    |
| Hay .....       | 50 " " "             |
| Stover.....     | 20 " " "             |
| Wheat bran..... | 93.7 " " "           |
| Corn meal.....  | \$1.00 " "           |
| Oil meal.....   | \$1.16¼ " "          |
| Butter.....     | 25½ cents per pound. |
| Skim milk.....  | 15 " " cwt.          |

Eighty per cent. of the total milk yield is assumed to be returned as skim milk.



COWS FED THE SILAGE RATION.

TABLE IV.—THE RECORD OF FOOD CONSUMED, MILK AND FAT PRODUCED, VALUE OF PRODUCT AND PROFIT.

I:—COWS TAKING THE SILAGE RATION:—

| Cow and month. | Live weight<br>Lbs. | Feed consumed       |                    |                  |                 |                 |              | Water drank.<br>Lbs. | Total cost of feed.<br>\$ | Average cost per day.<br>\$ | Milk yield,<br>Lbs. | Average per cent fat.<br>Per cent. | Total fat.<br>Lbs. | Skim milk.<br>Lbs. | Value skim milk and fat.<br>\$ | Profit over feed<br>\$ |
|----------------|---------------------|---------------------|--------------------|------------------|-----------------|-----------------|--------------|----------------------|---------------------------|-----------------------------|---------------------|------------------------------------|--------------------|--------------------|--------------------------------|------------------------|
|                |                     | Wheat bran.<br>Lbs. | Corn meal.<br>Lbs. | Oil meal<br>Lbs. | Silage.<br>Lbs. | Stover.<br>Lbs. | Hay.<br>Lbs. |                      |                           |                             |                     |                                    |                    |                    |                                |                        |
| TEENY'S 4th.   | Nov ...             | 848                 | 104                | 129              | .....           | 900             | 58 5         | .....                | 3 28                      | .109                        | 459 7               | 6.07                               | 27.9037            | 367 7              | 8 85                           | 5 57                   |
|                | Dec....             | 896                 | 96                 | 64               | 32              | 1426.75         | 60 25        | 123 75               | 4 08                      | .131                        | 433 4               | 6.56                               | 28.4310            | 346 7              | 8 98                           | 4 90                   |
|                | Jan....             | 910                 | 62                 | .....            | 62              | 1852.25         | .....        | 213.25               | 4 21                      | .135                        | 501 0               | 6 52                               | 32 6652            | 400 8              | 10 32                          | 6.11                   |
|                | Feb....             | 923                 | 58                 | .....            | 58              | 1690            | .....        | 188.                 | 3 85                      | .132                        | 486 1               | 6 70                               | 32 5687            | 388 8              | 10 27                          | 6.42                   |
|                | March.              | 957                 | 62                 | .....            | 62              | 1733            | .....        | 216.                 | 4 11                      | .132                        | 520.9               | 6 70                               | 34 9003            | 416 7              | 11 01                          | 6.90                   |
|                | April..             | 973                 | 60                 | .....            | 60              | 1657            | ..           | 202 5                | 3 93                      | .141                        | 482.3               | 6 40                               | 30 8672            | 385 8              | 9 76                           | 5.83                   |
| STAR'S 2d.     | Nov ...             | 1014                | 99                 | 154              | .....           | 900             | 57.25        | .....                | 3 48                      | .116                        | 552 0               | 4 50                               | 24 8400            | 441 6              | 8 05                           | 4 57                   |
|                | Dec....             | 1014                | 96                 | 64               | 32              | 1462.75         | 66.25        | 126.5                | 4 14                      | .133                        | 744 0               | 4 40                               | 29 7600            | 595 2              | 9 74                           | 5 60                   |
|                | Jan....             | 1022                | 62                 | .....            | 62              | 1860.           | .....        | 190 25               | 4 10                      | .132                        | 671 0               | 4 45                               | 29 8595            | 536 8              | 9 69                           | 5.59                   |
|                | Feb....             | 1057                | 58                 | .....            | 58              | 1730 50         | .....        | 203.25               | 3.96                      | .136                        | 556 3               | 5 40                               | 30 0402            | 445 0              | 9 61                           | 5 65                   |
|                | March               | 1078                | 62                 | .....            | 62              | 1841.           | .....        | 215.                 | 4.21                      | .135                        | 553.0               | 5.30                               | 29 3090            | 442.4              | 9 39                           | 5 18                   |
|                | April..             | 1072                | 60                 | .....            | 60              | 1769.           | .....        | 223.5                | 4.15                      | .138                        | 485 3               | 5 47                               | 26 5359            | 388 2              | 8.50                           | 4 35                   |
| MAY'S 2d.      | Dec....             | 1123                | 107                | 30               | 32              | 1438            | 88 25        | 131 5                | 3 95                      | .127                        | 511.7               | 4 40                               | 21.5148            | 409 3              | 7 31                           | 3 36                   |
|                | Jan....             | 1094                | 62                 | .....            | 62              | 1860            | .....        | 233.5                | 4.32                      | .139                        | 876.8               | 4 55                               | 38 1408            | 701.4              | 12 40                          | 8 08                   |
|                | Feb....             | 1139                | 58                 | .....            | 58              | 1740            | .....        | 216 25               | 4 04                      | .138                        | 765 3               | 4 70                               | 35 9691            | 612 2              | 11.62                          | 7.58                   |
|                | March.              | 1145                | 62                 | .....            | 62              | 1860            | .....        | 212                  | 4.21                      | .135                        | 725 3               | 4 16                               | 30 1725            | 580.2              | 9 85                           | 5 64                   |
|                | April..             | 1130                | 60                 | .....            | 60              | 1800            | ..           | 193.5                | 4 03                      | .134                        | 583 7               | 4 45                               | 26 6866            | 479 7              | 8 66                           | 4 63                   |
|                | May's 2d.           | 1130                | 60                 | .....            | 60              | 1800            | ..           | 193.5                | 4 03                      | .134                        | 583 7               | 4 45                               | 26 6866            | 479 7              | 8 66                           | 4 63                   |
| MAY'S 2d.      | Nov ...             | 1114                | 104                | 139              | .....           | 900             | 73.75        | .....                | 3 31                      | .110                        | 433 5               | 5 40                               | 18.6400            | 346 8              | 6 07                           | 2 76                   |
|                | Dec ...             | 1193                | 96                 | 64               | 32              | 1475            | 96.25        | 135.25               | 4 26                      | .137                        | 462 7               | 4 56                               | 19.7110            | 370 1              | 6 43                           | 2 17                   |
|                | Jan....             | 1205                | 62                 | .....            | 62              | 1860            | .....        | 217.25               | 4 24                      | .136                        | 432 2               | 4 30                               | 18.5846            | 345.7              | 6 05                           | 1 81                   |
|                | Feb....             | 1277                | 58                 | .....            | 58              | 1700            | .....        | 175.25               | 3 79                      | .130                        | 557 2               | 4 30                               | 16 6496            | 309 7              | 5.41                           | 1.62                   |
|                | Jan....             | 952                 | 87                 | .....            | 37              | 1271            | 107 25       | 112                  | 3 30                      | .106                        | 506.6               | 6 20                               | 31 4092            | 405 2              | 9 95                           | 6 65                   |
|                | Feb....             | 965                 | 58                 | .....            | 58              | 1639.25         | .....        | 178                  | 3 75                      | .129                        | 630.1               | 6.00                               | 41 400.0           | 552 0              | 13 15                          | 9.40                   |
| MAY'S 2d.      | March.              | 985                 | 62                 | .....            | 62              | 1641            | .....        | 207                  | 3 97                      | .127                        | 639.8               | 5.74                               | 38.4465            | 535 8              | 12 24                          | 8.27                   |
|                | April..             | 961                 | 60                 | .....            | 60              | 1587.5          | .....        | 205 5                | 3 87                      | .129                        | 606 4               | 5 42                               | 32.8668            | 485 1              | 10 51                          | 6.64                   |

TABLE IV.—THE RECORD OF FOOD CONSUMED, MILK AND FAT PRODUCED, VALUE OF PRODUCT AND PROFIT.—*Continued.*

## II:—COWS TAKING THE GRAIN RATION:—

| Cow and Month.    | Live weight. Lbs. | Feed consumed.   |                 |                |              |              |           | Water drank. Lbs. | Total cost of feed \$ | Average cost per day. \$ | Milk yield. Lbs. | Average per cent fat. | Total fat. Lbs. | Skim milk. Lbs. | Value skim milk and fat. \$ | Profit over feed. \$ |
|-------------------|-------------------|------------------|-----------------|----------------|--------------|--------------|-----------|-------------------|-----------------------|--------------------------|------------------|-----------------------|-----------------|-----------------|-----------------------------|----------------------|
|                   |                   | Wheat bran. Lbs. | Corn meal. Lbs. | Oil meal. Lbs. | Silage. Lbs. | Stover. Lbs. | Hay. Lbs. |                   |                       |                          |                  |                       |                 |                 |                             |                      |
| PHILLIPS' 4th.    | Nov ...           | 915              | 104             | 129            | .....        | 900          | 56.5      | .....             | 3.27                  | .109                     | 439.4            | 5.17                  | 22.7169         | 351.5           | 7.29                        | 4.02                 |
|                   | Dec....           | 931              | 163             | 155            | 36           | 637          | 238.25    | 12                | 4.67                  | .150                     | 439.1            | 5.32                  | 25.3601         | 351.2           | 7.48                        | 2.81                 |
|                   | Jan....           | 967              | 186             | 155            | 77.5         | .....        | 178.75    | 186               | 5.48                  | .176                     | 424.7            | 5.00                  | 21.2350         | 339.7           | 6.83                        | 1.35                 |
|                   | Feb....           | 1014             | 174             | 145            | 72.5         | .....        | 146.5     | 174               | 5.08                  | .175                     | 391.2            | 5.45                  | 21.3204         | 312.9           | 6.81                        | 1.73                 |
|                   | March..           | 1040             | 186             | 155            | 75.          | .....        | 162.5     | 180               | 5.39                  | .173                     | 401.8            | 5.52                  | 22.1794         | 321.4           | 7.08                        | 1.69                 |
|                   | April..           | 1060             | 178             | 150            | 75           | .....        | 74.5      | 254               | 5.46                  | .181                     | 327.6            | 5.65                  | 18.5094         | 262.0           | 5.90                        | 0.44                 |
| NERY-LETTE'S 4th. | Nov ...           | 767              | 104             | 129            | .....        | 900          | 48.75     | .....             | 3.26                  | .108                     | 351.8            | 5.55                  | 19.5249         | 281.4           | 6.23                        | 2.87                 |
|                   | Dec....           | 777              | 163             | 155            | 36           | 637.5        | 193       | .....             | 4.52                  | .145                     | 331.1            | 6.40                  | 24.3904         | 304.8           | 7.72                        | 3.20                 |
|                   | Jan....           | 790              | 186             | 155            | 77.5         | .....        | 193.5     | 179.75            | 5.37                  | .172                     | 364.9            | 6.05                  | 22.0764         | 291.9           | 7.01                        | 1.64                 |
|                   | Feb....           | 826              | 169             | 141.5          | 71.5         | .....        | 111.5     | 172.              | 4.91                  | .169                     | 277.8            | 6.48                  | 18.0014         | 222.2           | 5.69                        | 0.78                 |
| NELLY'S 4th.      | Dec....           | 946              | 163             | 155            | 36           | 493          | 240.25    | .....             | 4.47                  | .144                     | 717.5            | 4.80                  | 34.4400         | 574.0           | 11.10                       | 6.63                 |
|                   | Jan....           | 950              | 186             | 155            | 77.5         | .....        | 175.5     | 174.25            | 5.42                  | .174                     | 749.8            | 4.15                  | 31.1167         | 599.8           | 10.16                       | 4.74                 |
|                   | Feb....           | 971              | 173.5           | 144.5          | 72.5         | .....        | 155.25    | 170.5             | 5.08                  | .175                     | 664.1            | 4.45                  | 29.5524         | 531.2           | 9.59                        | 4.51                 |
|                   | March..           | 987              | 186             | 155            | 77.5         | .....        | 168       | 185               | 5.45                  | .175                     | 701.9            | 3.90                  | 27.3741         | 561.5           | 8.98                        | 3.53                 |
|                   | April..           | 968              | 180             | 150            | 75.          | .....        | 69        | 225               | 5.32                  | .177                     | 646.1            | 4.27                  | 27.5444         | 516.8           | 8.98                        | 3.66                 |
| FANCY'S 4th.      | Nov ...           | 1010             | 104             | 129            | .....        | 900          | 78.25     | .....             | 3.32                  | .110                     | 370.9            | 4.30                  | 15.9447         | 296.7           | 5.19                        | 1.87                 |
|                   | Dec....           | 1037             | 163             | 155            | 36           | 652.5        | 289.25    | .....             | 4.73                  | .152                     | 430.8            | 4.38                  | 18.8680         | 344.6           | 6.13                        | 1.40                 |
|                   | Jan....           | 1040             | 186             | 155            | 77.5         | .....        | 196.75    | 184.5             | 5.51                  | .177                     | 343.6            | 4.32                  | 14.8435         | 274.8           | 4.83                        | -0.68                |
|                   | Feb....           | 1155             | 174             | 145            | 72.5         | .....        | 177       | 174               | 5.15                  | .177                     | 261.6            | 4.60                  | 12.0336         | 203.2           | 3.19                        | -1.26                |
| MIAMI PRIDE       | Feb....           | 961              | 153             | 137            | 21           | 644          | 18        | 232.75            | 4.89                  | .168                     | 871.0            | 5.10                  | 47.0718         | 698.8           | 15.05                       | 10.16                |
|                   | Mar....           | 945              | 186             | 155            | 77.5         | .....        | 158       | 185               | 5.42                  | .174                     | 858.0            | 4.6                   | 39.9828         | 686.4           | 12.92                       | 7.50                 |
|                   | April..           | 928              | 180             | 150            | 75           | .....        | 68        | 249               | 5.44                  | .181                     | 639.7            | 6.02                  | 32.1129         | 511.7           | 10.32                       | 4.88                 |

SILAGE vs. GRAIN FOR DAIRY COWS.

TABLE V.—SUMMARY OF RECORD FOR THE MONTHS INCLUDED IN THE TEST.

| NAME OF COW                 | Number<br>of<br>months<br>in test. | Feed consumed. |         |         |        | Water<br>drank. | Total<br>milk<br>yield.<br>Lbs. | Fat.   | Cost<br>of<br>feed.<br>\$ | Value of<br>skim milk<br>and fat.<br>\$ | Profit<br>over<br>feed.<br>\$ |
|-----------------------------|------------------------------------|----------------|---------|---------|--------|-----------------|---------------------------------|--------|---------------------------|-----------------------------------------|-------------------------------|
|                             |                                    | Grain.         | Silage. | Stover. | Hay.   |                 |                                 |        |                           |                                         |                               |
|                             |                                    | Lbs.           | Lbs.    | Lbs.    | Lbs.   |                 |                                 |        |                           |                                         |                               |
| I:—COWS FED SILAGE RATION:— |                                    |                |         |         |        |                 |                                 |        |                           |                                         |                               |
| Teeny's 4th .....           | 4                                  | 484            | 6932 75 | .....   | 819 75 | 5405            | 1990.3                          | 131 00 | 16 10                     | 41.36                                   | 25 26                         |
| Star's 2nd.....             | 4                                  | 484            | 7200 5  | .....   | 832.   | 6471            | 2265.6                          | 115.74 | 16 42                     | 37.19                                   | 20 77                         |
| Patti's 5th .....           | 4                                  | 484            | 7260.   | .....   | 855 25 | 5677            | 2967.1                          | 130 97 | 16 60                     | 42 53                                   | 25 93                         |
| Vanity's 2nd.....           | 2                                  | 240            | 3560.   | .....   | 392 5  | 1864            | 819 4                           | 35.25  | 8 03                      | 11.46                                   | 3 43                          |
| May's 2nd.....              | 3                                  | 360            | 4867 75 | ....    | 590 5  | 3809            | 1966.3                          | 112.72 | 11 59                     | 35 90                                   | 24 31                         |
| Average for one month ..... | ..                                 | 120 7          | 1754.17 | ..      | 205.3  | 1366            | 588 7                           | 30.92  | 4 044                     | 9 908                                   | 5 864                         |
| II:—COWS FED GRAIN RATION   |                                    |                |         |         |        |                 |                                 |        |                           |                                         |                               |
| Phillips' 4th.....          | 1                                  | 1629.          | .       | 562 25  | 794    | 7712            | 1545.3                          | 83.24  | 21 41                     | 26 62                                   | 5.21                          |
| Nervilette's 4th.....       | 2                                  | 800 5          | .....   | 250     | 351 75 | 3372            | 642 7                           | 40.08  | 10 28                     | 12 70                                   | 2 42                          |
| Nelly's 4th .....           | 4                                  | 1632 5         | .....   | 567.75  | 754.75 | 8471            | 2761 9                          | 115 59 | 21 27                     | 37 71                                   | 16 44                         |
| Fancy's 4th .....           | 2                                  | 810.           | .....   | 373 75  | 354 5  | 3364            | 605 2                           | 26 88  | 10 66                     | 8 72                                    | —1 94                         |
| Miami Pride .....           | 2                                  | 823 5          | .       | 226     | 432    | 4571            | 1497 7                          | 72 10  | 10 86                     | 23.24                                   | 12 38                         |
| Average for one month ..... | ..                                 | 496.8          | .       | 11 41   | 192 21 | 1966            | 501 8                           | 24 11  | 5 32                      | 7 75                                    | 2 65                          |

Table IV gives the complete record of each cow, month by month, beginning two months before the test was started, when this was possible, and continuing through the test. The cows which did not calve in time to give this earlier record have in most instances their dairy work recorded for a month at least before the test began. The date of last calf will be found in Table II.

This record includes the live weight, kinds and amount of feed, the amount of water drank, the yield of milk, average per cent. of fat, total butter fat, the value of the butter fat and skim milk, total cost of feed and net profit over feed consumed.

Table V gives in compact forms the record of each cow for the period covered by the test, and the average amount of feed consumed, milk and butter fat produced, value of products, cost of feed and net profit per cow per month upon each ration.

DRY MATTER CONSUMED PER DAY:

|                       |           |
|-----------------------|-----------|
| In silage ration..... | 20.16 lbs |
| In grain ration.....  | 20.51 lbs |

TABLE VI.—PRODUCT PER HUNDRED POUNDS OF DRY MATTER:

| RATION.     | Milk<br>Lbs. | Fat.<br>Lbs. |
|-------------|--------------|--------------|
| Silage..... | 96 7         | 5 08         |
| Grain.....  | 81 3         | 3.90         |

TABLE VII.—COST OF FEED PER UNIT OF PRODUCT:

| RATION.     | Per<br>100 lbs.<br>milk. | Per<br>1 lb.<br>fat. |
|-------------|--------------------------|----------------------|
| Silage..... | \$0 687                  | \$0.131              |
| Grain.....  | 1 055                    | 0 221                |

It is quite evident from the data given that the cows fed the silage ration have produced considerably more milk and fat, at a smaller expenditure for feed, resulting in more than double the profit. The question arises, however, how much of this increase in production is due to the ration fed and how much to the cow? The cows taking the silage ration appear to be somewhat better producers, due possibly in part to the fact that they were not as far along in lactation by 24 days, on the average, upon entering the test.

It is probable that the comparison of actual yields of milk and butter fat is not as reliable a guide to the utility of the two rations as the comparison of each cow with herself, "before and after" taking the ration.

The following table gives the average daily record of each cow during the month of November, except those not in milk for this month—and for these the first full month after calving, and for comparison, their average daily product of milk and fat for the entire test, with the per cent. of gain or loss over their first month in question.

TABLE VIII.—DAILY MILK AND FAT YIELD OF EACH COW FOR THE MONTH OF NOVEMBER AS COMPARED WITH THE AVERAGE DAILY YIELD FOR THE ENTIRE TEST.

| NAME OF COW.                 | Av. yield per day<br>during November. |              | Av. yield per day<br>for the entire test. |              | Gain +<br>or<br>Loss — |                   |
|------------------------------|---------------------------------------|--------------|-------------------------------------------|--------------|------------------------|-------------------|
|                              | Milk.<br>Lbs.                         | Fat.<br>Lbs. | Milk,<br>Lbs.                             | Fat.<br>Lbs. | Milk.<br>Per cent.     | Fat.<br>Per cent. |
| I:—COWS FED SILAGE RATION:-- |                                       |              |                                           |              |                        |                   |
| Teeny's 4th .....            | 15.3                                  | 0.93         | 16.4                                      | 1.082        | + 7.19                 | +16.34            |
| Star's 2nd .....             | 18.4                                  | 0.828        | 18.7                                      | 0.957        | + 1.63                 | +15.58            |
| Patti's 5th .....            | a 28.3                                | 1.23         | 24.5                                      | 1.082        | -13.43                 | -12.03            |
| Vanity's 2d .....            | 14.4                                  | 0.621        | 13.7                                      | 0.588        | - 4.86                 | - 5.31            |
| May's 2d .....               | b 23.8                                | 1.428        | 21.8                                      | 1.252        | - 8.40                 | -12.32            |
| Average per day .....        | 20.08                                 | 1.006        | 19.51                                     | 1.025        | - 2.84                 | + 1.89            |
| II:—COWS FED GRAIN RATION:-- |                                       |              |                                           |              |                        |                   |
| Phillips' 4th .....          | 14.6                                  | 0.757        | 12.8                                      | 0.688        | -12.33                 | - 9.12            |
| Nervilette's 4th .....       | 11.7                                  | 0.65         | 10.7                                      | 0.668        | - 8.55                 | + 2.77            |
| Nelly's 4th .....            | c 23.1                                | 1.111        | 22.8                                      | 0.955        | - 1.29                 | -14.04            |
| Fancy's 4th .....            | 12.4                                  | 0.531        | 10.1                                      | 0.448        | -18.55                 | -15.63            |
| Miami Pride .....            | b 30.0                                | 1.623        | 24.6                                      | 1.182        | -18.00                 | -27.17            |
| Average per day .....        | 18.34                                 | 0.931        | 16.67                                     | 0.799        | - 9.11                 | -14.18            |

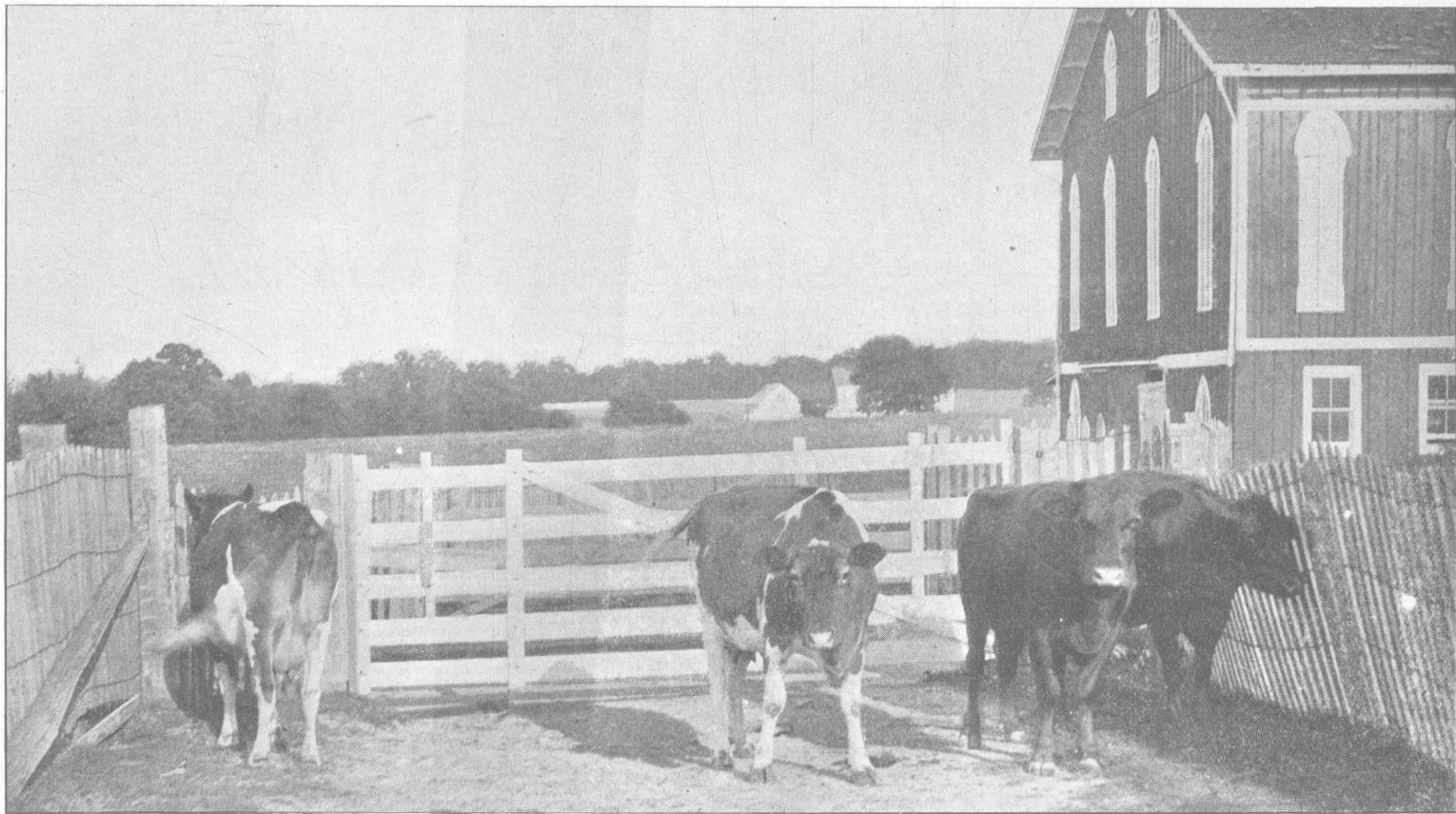
a—January.

b—February.

c—December.

In the consideration of Table VIII, wherein we have the average daily product of each cow for the month previous to the change in ration—or the first month of the test in the case of two cows—compared with their average daily product during the entire test, it will be noted that two of the silage fed cows gained in both milk and fat, while only one of the grain fed cows made a slight gain in fat. Taking the average of the herds, the cows fed the silage ration shrank 2.84 per cent. in milk and gained 1.89 per cent., in fat while the cows fed the grain ration shrank 9.11 per cent. in milk and 14.18 per cent in fat.





COWS FED THE GRAIN RATION.

## GAIN OR LOSS IN LIVE WEIGHT.

The two rations should be compared in their effect upon the live weight of the animal from month to month. In the following table is given the weight of each cow, beginning one month previous to the starting of the test and continuing until its close. The figures given are the average of two weighings, made the last two days of each month.

TABLE IX.—LIVE WEIGHT FROM NOVEMBER TO APRIL.

| NAME OF COW                  | Live weight in pounds for month of: |       |       |      |       |        | Pounds of |      | Average live weight 1903. |
|------------------------------|-------------------------------------|-------|-------|------|-------|--------|-----------|------|---------------------------|
|                              | Nov.                                | Dec.  | Jan.  | Feb. | March | April. | Gain.     | Loss |                           |
| I:—COWS FED SILAGE RATION:—  |                                     |       |       |      |       |        |           |      |                           |
| Teeny's 4th . . . . .        | 848                                 | 896   | 910   | 923  | 957   | 973    | 77        | .... | 105                       |
| Star's 2nd . . . . .         | 1014                                | 1014  | 1022  | 1057 | 1078  | 1072   | 58        | .... | 1053                      |
| Patti's 5th . . . . .        | *1319                               | 1123  | 1094  | 1139 | 1145  | 1130   | 7         | ...  | 1154                      |
| Vanity's 2nd . . . . .       | 1114                                | 1193  | 1205  | 1277 | ....  |        | 84        | .... | 1215                      |
| May's 2nd . . . . .          | 1014                                | *1066 | 952   | 985  | 985   | 961    | 9         | ...  | 979                       |
| Total pounds gain . . . . .  | ...                                 | ...   | ....  | .    |       |        | 235       |      |                           |
| II:—COWS FED GRAIN RATION:-- |                                     |       |       |      |       |        |           |      |                           |
| Phillips' 4th . . . . .      | 915                                 | 931   | 967   | 1014 | 1040  | 1060   | 129       | .... | 9.3                       |
| Nervilette's 4th . . . . .   | 767                                 | 777   | 790   | 826  | ..    | ...    | 49        | .... | 7.2                       |
| Nelly's 4th . . . . .        | 947                                 | 946   | 950   | 971  | 987   | 968    | 22        |      | 1 03                      |
| Fancy's 4th . . . . .        | 1010                                | 1037  | 1040  | 1155 | ....  | ....   | 118       | .... | 10.2                      |
| Miami Pride . . . . .        | 1037                                | 1095  | *1117 | 961  | 945   | 928    | .         | 33   | 9.9                       |
| Total pounds gain . . . . .  | ....                                | .     | ..    | ...  | ....  | ..     | 285       | ...  | ....                      |

\*Three of the cows calved shortly after their weights had been taken as indicated above. These abnormal weights of course should not be used in computing gain or loss. Accordingly the weight for the following month is used.

The gain or loss is computed from the December weights, taken just previous to the beginning of the test, January 1st, as compared with the April weights taken at its completion.

## THE EFFECT OF THE RATIONS UPON THE PER CENT OF FAT IN MILK.

Samples of each milking were taken and tests were made once a week of the composite sample. The four or five tests made each month are averaged for the monthly test.

In comparing the effect of the change in ration upon the per cent. of butter fat it should be remembered that during the month of November and up to December 9th all the cows reported upon in this test were uniformly fed 30 pounds silage and 10 pounds of grain. Beginning with the latter date the silage was gradually taken from one lot and as gradually increased to the other lot. The grain was changed inversely with the silage, and December 30th each cow was taking the ration as provided for by the test.

TABLE X.—THE PER CENT OF FAT IN MILK. NOVEMBER TO APRIL.

| NAME OF COW.                |                                  | Average percent fat for months of: |       |       |       |       |       |
|-----------------------------|----------------------------------|------------------------------------|-------|-------|-------|-------|-------|
|                             |                                  | Nov.                               | Dec   | Jan.  | Feb   | Mar.  | April |
| I:—COWS FED SILAGE RATION:— |                                  |                                    |       |       |       |       |       |
| 1                           | Teeny's 4th .....                | 6 07                               | 6.56  | 6.52  | 6.70  | 6.70  | 6.40  |
| 2                           | Star's 2nd .....                 | 4 52                               | 4 00  | 4 45  | 5 40  | 5.30  | 5.47  |
| 3                           | Patti's 5th .....                | ....                               | 4 40  | 4.35  | 4.70  | 4.16  | 4.45  |
| 4                           | Vanity's 2nd .....               | 4.30                               | 4 26  | 4.30  | 4.30  | ....  | ....  |
| 5                           | May's 2nd .....                  | ....                               | ...   | 6 20  | 6.00  | 5.74  | 5.42  |
|                             | Average of Nos. 1, 2, 3, 4 ..... | ....                               | 4 805 | 4 905 | 5.275 | ....  | ....  |
|                             | Average of Nos. 1, 2, 3 .....    | ....                               | 4 986 | 5.106 | 5.60  | 5.386 | 5.44  |
| II:—COWS FED GRAIN RATION:— |                                  |                                    |       |       |       |       |       |
| 6                           | Phillips' 4th .....              | 5 17                               | 5.32  | 5.00  | 5.45  | 5.52  | 5.65  |
| 7                           | Nervillette's 4th .....          | 5 55                               | 6.40  | 6 05  | 6.48  | ....  | ....  |
| 8                           | Nelly's 4th .....                | ....                               | 4.80  | 4.15  | 4 45  | 3.90  | 4.27  |
| 9                           | Fancy's 4th .....                | 4.30                               | 4.38  | 4.32  | 4.60  | ....  | ....  |
| 10                          | Miami Pride .....                | ....                               | ....  | ....  | 5.40  | 4.66  | 5.02  |
|                             | Average of Nos. 6, 7, 8, 9 ..... | ....                               | 5 225 | 4.88  | 5 245 | ....  | ....  |
|                             | Average of Nos. 6, 8 .....       | ....                               | 5.06  | 4.575 | 4.95  | 4.71  | 4.96  |

The somewhat arbitrary comparisons are made necessary from the fact that three cows were started in the test which it seemed inadvisable to continue to its completion, and two others were entered in the middle of the test. Averaging the monthly fat tests of such cows as can be legitimately used in this way it seems evident that the silage fed cows held up rather better in per cent. of fat than did the grain-fed cows.

#### THE EFFECT OF THE RATIONS UPON THE AMOUNT OF WATER DRANK.

Two rations differing so widely in the amount of water they carry would seem likely to affect the amount of water drank. Table XI shows the average number of pounds of water drank per cow per day during the test and, for comparison, the average daily milk and fat product.

Ordinarily it is counted a good thing to increase the consumption of water. Silage has been objected to by some because "cows would not drink as much when eating silage." Table XII shows that they do not need to drink as much in order to get considerably more water than they take on a "dry" ration. Although drinking only seventy per cent as much water, the cows taking the silage ration really consumed one hundred and thirty five per cent. of the water consumed by the cows on the dry ration.

TABLE XI.—AVERAGE DAILY AMOUNT OF WATER DRANK, AND MILK AND FAT PRODUCED DURING THE TEST.

| NAME OF COW.                | Pounds per day. |           |       |
|-----------------------------|-----------------|-----------|-------|
|                             | Water<br>drank. | Milk      | Fat   |
|                             |                 | Produced. |       |
| I:—COWS FED SILAGE RATION:— |                 |           |       |
| Teeny's 4th .....           | 44.7            | 16 4      | 1.082 |
| Star's 2nd .....            | 53 5            | 18 7      | 0 957 |
| Patti's 5th .....           | 46 9            | 24 5      | 1 082 |
| Vanity's 2nd .....          | 31 0            | 13 7      | 0.588 |
| May's 2d .....              | 42 3            | 21 8      | 1.252 |
| Average .....               | 45 3            | 19 51     | 1 025 |
| II:—COWS FED GRAIN RATION:— |                 |           |       |
| Phillips' 4th .....         | 64 0            | 12 8      | 0 688 |
| Nervilette's 4th .....      | 56 2            | 10 7      | 0 668 |
| Nelly's 4th .....           | 70 0            | 22 8      | 0 955 |
| Fancy's 4th .....           | 56 0            | 10 1      | 0 448 |
| Miami Pride .....           | 75 0            | 24 6      | 1 182 |
| Average.....                | 65 0            | 16 67     | 0 799 |

TABLE XII.—AVERAGE DAILY CONSUMPTION OF WATER.

| RATION.     | Total<br>daily<br>feed<br>ration.<br>Lbs. | Dry<br>matter<br>in<br>ration.<br>Lbs. | Water<br>in<br>ration<br>Lbs. | Water<br>drank.<br>Lbs. | Total<br>water<br>consumed.<br>Lbs. | Total<br>water per<br>100 lbs.<br>dry<br>matter. |
|-------------|-------------------------------------------|----------------------------------------|-------------------------------|-------------------------|-------------------------------------|--------------------------------------------------|
| Silage..... | 68.8                                      | 20.16                                  | 48.64                         | 45.3                    | 95.94                               | 466                                              |
| Grain.....  | 24.6                                      | 20.51                                  | 4.09                          | 65.0                    | 69.09                               | 337                                              |

## SUMMARY.

The prevailing high prices of grain feeds in the face of very moderate prices for dairy products have reduced the dairyman's profit to a point where it is a question with him whether he can make the cow pay for the large grain ration he has been accustomed to feed. If he can dispense with half the grain he has been feeding without materially reducing his production of milk and butter fat his chances for profit have increased.

The object of this experiment was to determine whether silage might not be substituted for a considerable portion of the grain usually fed to dairy cows. Two rations were fed carrying practically the same amount of dry matter. In one ration over fifty per cent. of this dry matter was derived from silage and less than eighteen per cent was derived from grain.

In the other ration over fifty-seven per cent of the dry matter was derived from grain, no silage being fed.

Ten cows, representing five different breeds, were fed these rations from two to four months, five cows taking the test the full four months.

The cows fed the silage ration produced 96.7 pounds of milk and 5.08 pounds of butter fat per hundred pounds of dry matter.

The cows fed the grain ration produced 81.3 pounds of milk and 3.9 pounds of butter fat per hundred pounds of dry matter.

The cost of feed per hundred pounds of milk was \$0.687 with the silage ration and \$1.055 with the grain ration. The cost of feed per pound of butter fat was 13.1 cents with the silage ration and 22.1 cents with the grain ration.

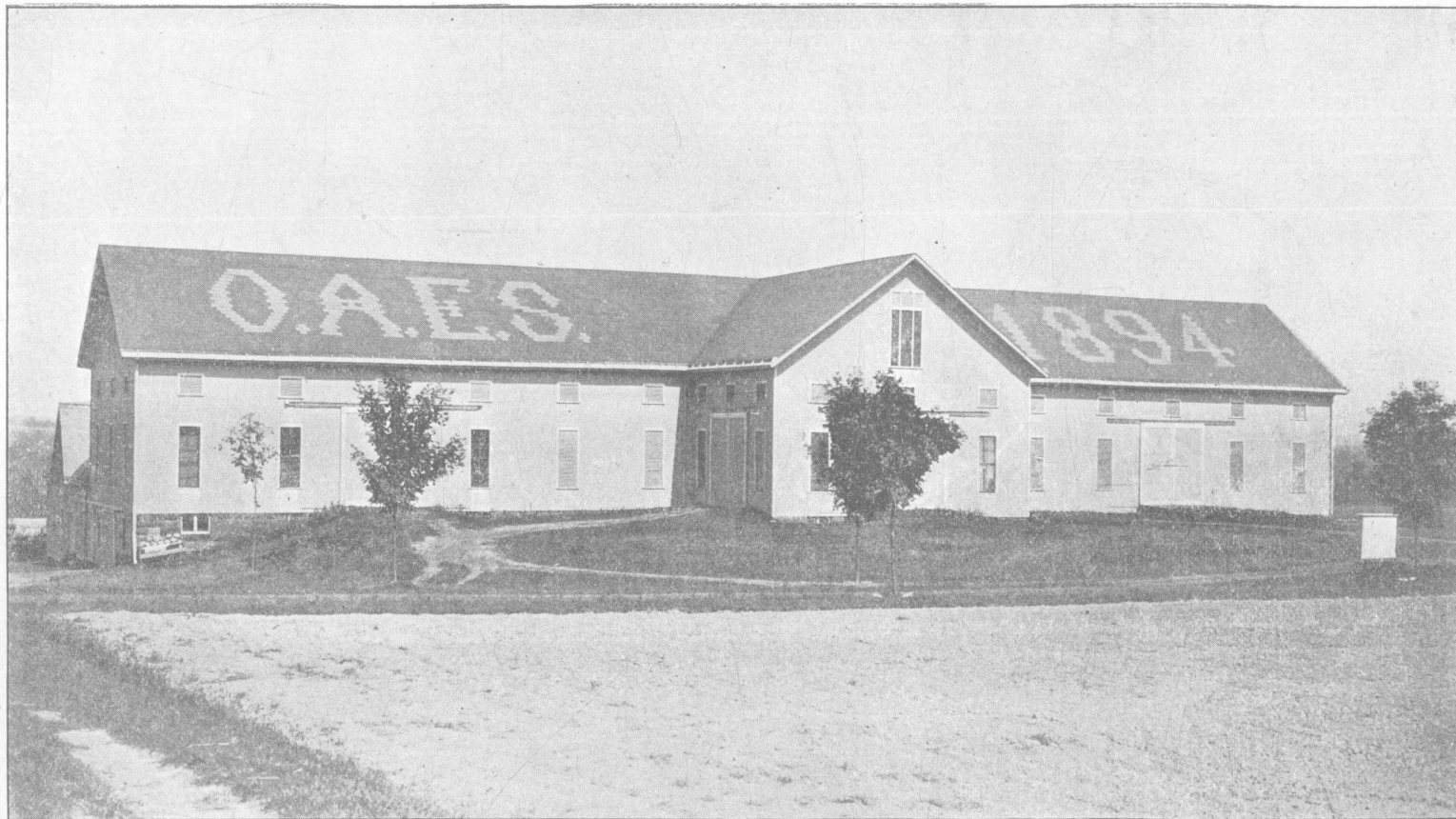
The average net profit per cow per month (over cost of feed) was \$5.864 with the silage ration and \$2.465 with the grain ration.

Comparing the average daily product of each cow for the *entire test* with her average daily product for the month previous to the change in ration (or the first month of their test in the case of two cows), the cows fed the silage ration shrank 2.84 per cent. in milk and gained 1.89 per cent in butter fat production. The cows fed the grain ration shrank 9.11 per cent. in milk and 14.18 in butter fat production.

Upon the conclusion of the experiment each lot of cows was found to have gained in live weight: The silage fed cows an average of 47 pounds per head, the grain fed cows an average of 57 pounds per head.

The facts herein reported seem to justify the conclusion that silage can be made to take the place of a considerable portion of the grain ration. It is believed that by growing more of the feeds rich in protein—clover, alfalfa, soy beans, cowpeas, field peas, vetches, and ensiling them, or feeding them as hay, it will be possible to further reduce the amount of grain fed.

It is the expectation of the Station to continue the experiment the following winter.



"WHERE THE BATTLE WAS FOUGHT"

## AVERAGE COMPOSITION OF FEEDING STUFFS.

The following table has been compiled largely from the revised edition of Farmers' Bulletin No. 22 of the U. S. Department of Agriculture. Other authorities used are Jordan's "The Feeding of Animals;" Henry's "Feeds and Feeding;" Bulletin No. 175 New Jersey Agricultural Experiment Station; Bulletin No. 93 Massachusetts Agricultural Experiment Station; Bulletin No. 66 Iowa Agricultural Experiment Station; Year Book for 1896, U. S. Department of Agriculture and Bulletin 127 of the Ohio Agricultural Experiment Station.

TABLE XIII—PERCENTAGE COMPOSITION OF FEEDING STUFFS.

| FEEDING STUFF.                                | Water | Ash | Protein | Fiber | Nitrogen-free extract | Ether extract | Nitrogen | Phosphoric acid | Potash |
|-----------------------------------------------|-------|-----|---------|-------|-----------------------|---------------|----------|-----------------|--------|
| GREEN FODDERS.                                |       |     |         |       |                       |               |          |                 |        |
| Corn fodder:                                  |       |     |         |       |                       |               |          |                 |        |
| Flint varieties.....                          | 79.8  | 1.1 | 2.0     | 4.3   | 12.1                  | 0.7           | ....     | ....            | ....   |
| Dent varieties.....                           | 79.0  | 1.2 | 1.7     | 5.6   | 12.0                  | 0.5           | .41      | .15             | .33    |
| Dent varieties cut after glazing.....         | 73.4  | 1.5 | 2.0     | 6.7   | 15.5                  | 0.9           | ....     | ....            | ....   |
| Sweet varieties.....                          | 79.1  | 1.3 | 1.9     | 4.4   | 12.8                  | 0.5           | ....     | ....            | ....   |
| Sorghum fodder.....                           | 79.4  | 1.1 | 1.3     | 6.1   | 11.6                  | 0.5           | .23      | .09             | .23    |
| Rye fodder.....                               | 76.6  | 1.8 | 2.6     | 11.6  | 6.8                   | 0.6           | .33      | .15             | .73    |
| Barley fodder.....                            | 79.0  | 1.8 | 2.7     | 7.9   | 8.0                   | 0.6           | .33      | .20             | .51    |
| Oat fodder.....                               | 62.2  | 2.5 | 3.4     | 11.2  | 19.3                  | 1.4           | .49      | .13             | .38    |
| Redtop, in bloom.....                         | 65.3  | 2.3 | 2.8     | 11.0  | 17.7                  | 0.9           | ....     | ..              | ....   |
| Tall oat grass, in bloom.....                 | 69.5  | 2.0 | 2.4     | 9.4   | 15.8                  | 0.9           | ....     | ....            | ....   |
| Orchard grass, in bloom.....                  | 73.0  | 2.0 | 2.6     | 8.2   | 13.3                  | 0.9           | .43      | .16             | .76    |
| Meadow fescue, in bloom.....                  | 69.9  | 1.8 | 2.4     | 10.3  | 14.3                  | 0.8           | ....     | ....            | ....   |
| Italian rye grass, in bloom.....              | 73.2  | 2.5 | 3.1     | 6.8   | 13.3                  | 1.3           | .54      | .29             | 1.14   |
| Timothy, at different stages.....             | 61.6  | 2.1 | 3.1     | 11.8  | 20.2                  | 1.2           | .48      | .26             | .76    |
| Kentucky blue grass, at different stages..... | 65.1  | 2.8 | 4.1     | 9.1   | 17.6                  | 1.3           | ....     | ....            | ....   |
| Hungarian grass.....                          | 71.1  | 1.7 | 3.1     | 9.2   | 14.2                  | 0.7           | .39      | .16             | .55    |
| Red clover, at different stages.....          | 70.8  | 2.1 | 4.4     | 8.1   | 13.5                  | 1.1           | .53      | .13             | .46    |
| Alsike clover, in bloom.....                  | 74.8  | 2.0 | 3.9     | 7.4   | 11.0                  | 0.9           | .44      | .11             | .20    |
| Crimson clover.....                           | 80.9  | 1.7 | 3.1     | 5.2   | 8.4                   | 0.7           | .43      | .13             | .49    |
| Alfalfa, at different stages.....             | 71.8  | 2.7 | 4.8     | 7.4   | 12.3                  | 1.0           | .72      | .13             | .56    |
| Cow pea.....                                  | 83.6  | 1.7 | 2.4     | 4.8   | 7.1                   | 0.4           | .27      | .10             | .31    |
| Soy bean.....                                 | 75.1  | 2.6 | 4.0     | 6.7   | 10.6                  | 1.0           | .29      | .15             | .53    |
| Rape.....                                     | 85.7  | 2.0 | 2.4     | 2.2   | 7.1                   | 0.6           | .45      | .15             | .36    |
| SILAGE.                                       |       |     |         |       |                       |               |          |                 |        |
| Corn silage.....                              | 77.3  | 1.4 | 1.9     | 5.9   | 12.6                  | 0.9           | .24      | .11             | .37    |
| Recent analyses, corn more mature.....        | 74.4  | 1.5 | 2.2     | 5.8   | 15.0                  | 1.1           | ....     | ....            | ....   |
| Sorghum silage.....                           | 76.1  | 1.1 | 0.8     | 6.4   | 15.3                  | 0.3           | .13      | .15             | .19    |
| Red clover silage.....                        | 72.0  | 2.6 | 4.2     | 8.4   | 11.6                  | 1.2           | .61      | ..              | ....   |

TABLE XIII.—PERCENTAGE COMPOSITION OF FEEDING STUFFS.—*Continued.*

| FEEDING STUFF.                           | Water | Ash. | Protein. | Fiber | Nitrogen-free extract | Ether extract | Nitrogen | Phosphoric acid | Po-ash |
|------------------------------------------|-------|------|----------|-------|-----------------------|---------------|----------|-----------------|--------|
| <i>SILAGE.—Continued.</i>                |       |      |          |       |                       |               |          |                 |        |
| Soy bean silage. ....                    | 74.2  | 2.8  | 4.1      | 9.7   | 6.9                   | 2.2           | .71      | .16             | .75    |
| Cowpea silage .....                      | 79.3  | 2.9  | 2.7      | 6.0   | 7.6                   | 1.5           | .44      | .15             | .46    |
| Field pea vine silage .....              | 50.1  | 3.5  | 5.9      | 13.0  | 26.0                  | 1.6           | ....     | ...             | ....   |
| Corn and soy bean silage.....            | 76.0  | 2.4  | 2.5      | 7.2   | 11.1                  | 0.8           | ....     | ...             | ...    |
| Apple pomace.....                        | 85.0  | 0.6  | 1.2      | 3.3   | 8.8                   | 1.1           | .32      | .15             | .40    |
| <i>HAY, STRAW AND DRY COARSE FODDER.</i> |       |      |          |       |                       |               |          |                 |        |
| Corn fodder, field cured.....            | 31.1  | 4.1  | 5.1      | 19.9  | 38.3                  | 1.5           | 1.76     | .54             | .89    |
| Corn leaves, field cured.....            | 30.0  | 5.5  | 6.0      | 21.4  | 35.7                  | 1.4           | ....     | ..              | ....   |
| Corn stover, field cured.....            | 30.0  | 3.9  | 4.5      | 24.1  | 36.1                  | 1.4           | 1.04     | .29             | 1.40   |
| Barley hay, cut in milk .....            | 15.0  | 4.2  | 8.8      | 24.7  | 44.9                  | 2.4           | ....     | ..              | ....   |
| Oat hay, cut in milk .....               | 15.0  | 5.2  | 9.3      | 29.2  | 39.0                  | 2.3           | 1.19     | .67             | 2.54   |
| Redtop, cut in bloom.....                | 8.7   | 4.9  | 8.0      | 29.9  | 46.4                  | 2.1           | 1.15     | .36             | 1.02   |
| Orchard grass .....                      | 9.9   | 6.0  | 8.1      | 32.4  | 41.0                  | 2.6           | 1.31     | .41             | 1.88   |
| Timothy, cut in full bloom .....         | 15.0  | 4.5  | 6.0      | 29.6  | 41.9                  | 3.0           | 1.26     | .53             | .90    |
| Timothy, cut when nicely ripe.....       | 14.1  | 3.9  | 5.0      | 31.1  | 43.7                  | 2.2           | ....     | ...             | ....   |
| Kentucky blue grass.....                 | 21.2  | 6.3  | 7.8      | 23.0  | 37.8                  | 3.9           | 1.19     | .40             | 1.57   |
| Hungarian grass.....                     | 7.7   | 6.0  | 7.5      | 27.7  | 49.0                  | 2.1           | 1.20     | .35             | 1.30   |
| Meadow fescue .....                      | 20.0  | 6.8  | 7.0      | 25.9  | 38.4                  | 2.7           | .99      | .40             | 2.10   |
| Mixed grasses.....                       | 15.3  | 5.5  | 7.4      | 27.2  | 42.1                  | 2.5           | 1.41     | .27             | 1.55   |
| Swamp hay .....                          | 11.6  | 6.7  | 7.2      | 26.6  | 45.9                  | 2.0           | ....     | ...             | ...    |
| Red clover.....                          | 15.3  | 6.2  | 12.3     | 24.8  | 38.1                  | 3.3           | 2.07     | .38             | 2.20   |
| Red clover in bloom .....                | 20.8  | 6.6  | 12.4     | 21.9  | 33.8                  | 4.5           | ....     | ...             | ....   |
| Alsike clover .....                      | 9.7   | 8.3  | 12.8     | 25.6  | 40.7                  | 2.9           | 2.34     | .67             | 2.23   |
| White clover.....                        | 9.7   | 8.3  | 15.7     | 24.1  | 39.3                  | 2.9           | 2.75     | .52             | 1.81   |
| Crimson clover .....                     | 9.6   | 8.6  | 15.2     | 27.2  | 36.6                  | 2.8           | 2.05     | .40             | 1.31   |
| Japan clover .....                       | 11.0  | 8.5  | 13.8     | 24.0  | 39.0                  | 3.7           | ....     | ...             | ....   |
| Vetch .....                              | 11.3  | 7.9  | 17.0     | 25.4  | 36.1                  | 2.3           | 3.68     | .97             | 2.44   |
| Alfalfa .....                            | 8.4   | 7.4  | 14.3     | 25.0  | 42.7                  | 2.2           | 2.19     | .51             | 1.68   |
| Cowpea .....                             | 10.7  | 7.5  | 16.6     | 20.1  | 42.2                  | 2.9           | 1.95     | .52             | 1.47   |
| Soy bean .....                           | 11.3  | 7.2  | 15.4     | 22.3  | 38.6                  | 5.2           | 2.32     | .67             | 1.08   |
| Flat pea .....                           | 8.4   | 7.9  | 22.9     | 26.2  | 31.4                  | 3.2           | 3.31     | .51             | 1.69   |
| Pea vines.....                           | 15.0  | 6.7  | 13.7     | 24.7  | 37.6                  | 2.3           | 2.29     | .68             | 2.32   |
| Soy bean straw.....                      | 10.1  | 5.8  | 4.6      | 40.4  | 37.4                  | 1.7           | 1.75     | .40             | 1.32   |
| Wheat straw .....                        | 9.6   | 4.2  | 3.4      | 38.1  | 43.4                  | 1.3           | .59      | .12             | .51    |
| Rye straw .....                          | 7.1   | 3.2  | 3.0      | 38.9  | 46.6                  | 1.2           | .46      | .28             | .79    |
| Oat straw .....                          | 9.2   | 5.1  | 4.0      | 37.0  | 42.4                  | 2.3           | .62      | .20             | 1.24   |
| Luckwheat straw .....                    | 9.9   | 5.5  | 5.2      | 43.0  | 35.1                  | 1.3           | 1.24     | .13             | 1.14   |



TABLE XIII—PERCENTAGE COMPOSITION OF FEEDING STUFFS. - *Continued.*

| FEEDING STUFF.                          | Water | Ash | Protein | Fiber | Nitrogen-free extract | Ether extract | Nitrogen | Phosphoric acid | Potash |
|-----------------------------------------|-------|-----|---------|-------|-----------------------|---------------|----------|-----------------|--------|
| ROOTS AND TUBERS.                       |       |     |         |       |                       |               |          |                 |        |
| Potatoes.....                           | 78.9  | 1.0 | 2.1     | 0.6   | 17.3                  | 0.1           | .32      | .12             | .46    |
| Sweet potatoes.....                     | 71.1  | 1.0 | 1.5     | 1.3   | 24.7                  | 0.4           | .23      | .10             | .50    |
| Red beets.....                          | 88.5  | 1.0 | 1.5     | 0.9   | 8.0                   | 0.1           | .24      | .09             | .44    |
| Sugar beets.....                        | 86.7  | 0.8 | 1.5     | 0.9   | 9.9                   | 0.1           | .22      | .10             | .48    |
| Mangel-wurzels.....                     | 91.2  | 1.0 | 1.4     | 0.8   | 5.4                   | 0.2           | .19      | .09             | .38    |
| Turnips.....                            | 90.6  | 0.8 | 1.3     | 1.2   | 5.9                   | 0.2           | .18      | .10             | .39    |
| Ruta-bagas'.....                        | 88.6  | 1.2 | 1.2     | 1.3   | 7.5                   | 0.2           | .19      | .12             | .49    |
| Carrots.....                            | 88.6  | 1.0 | 1.1     | 1.3   | 7.6                   | 0.4           | .15      | .09             | .51    |
| Artichokes.....                         | 78.0  | 1.8 | 2.4     | 0.9   | 16.8                  | 0.1           | .26      | .14             | .47    |
| GRAINS AND OTHER SEEDS.                 |       |     |         |       |                       |               |          |                 |        |
| Corn: Dent, all analyses.....           | 10.6  | 1.5 | 10.3    | 2.2   | 70.4                  | 5.0           | 1.82     | .70             | .40    |
| Flint, all analyses.....                | 11.3  | 1.4 | 10.5    | 1.7   | 70.1                  | 5.0           | ..       | ..              | ..     |
| Sweet, all analyses.....                | 8.8   | 1.9 | 11.6    | 2.8   | 66.8                  | 8.1           | 1.84     | .57             | .37    |
| Pop varieties.....                      | 10.7  | 1.5 | 11.2    | 1.8   | 69.6                  | 5.2           | 1.79     | ..              | ..     |
| Sorghum.....                            | 12.8  | 2.1 | 9.1     | 2.6   | 69.8                  | 3.6           | 1.48     | .81             | .42    |
| Barley.....                             | 10.9  | 2.4 | 12.4    | 2.7   | 69.8                  | 1.8           | 1.98     | .79             | .48    |
| Oats.....                               | 11.0  | 3.0 | 11.8    | 9.5   | 59.7                  | 5.0           | 1.88     | .82             | .62    |
| Rye.....                                | 11.6  | 1.9 | 10.6    | 1.7   | 72.5                  | 1.7           | 1.76     | .82             | .54    |
| Wheat, all varieties.....               | 10.5  | 1.8 | 11.9    | 1.8   | 71.9                  | 2.1           | ..       | ..              | ..     |
| Winter varieties, all analyses.....     | 10.5  | 1.8 | 11.8    | 1.8   | 72.0                  | 2.1           | 1.88     | .89             | .61    |
| Spring varieties.....                   | 10.4  | 1.9 | 12.5    | 1.8   | 71.2                  | 2.2           | 2.00     | .70             | .39    |
| Buckwheat.....                          | 12.6  | 2.0 | 10.0    | 8.7   | 64.5                  | 2.2           | 1.44     | .44             | .21    |
| Sunflower seed (whole).....             | 8.6   | 2.6 | 16.3    | 29.9  | 21.4                  | 21.2          | 2.28     | 1.22            | .56    |
| Cotton seed, whole (with hulls).....    | 9.1   | 4.0 | 19.6    | 18.9  | 28.3                  | 20.1          | 3.13     | 1.27            | 1.17   |
| Flaxseed.....                           | 9.2   | 4.3 | 22.6    | 7.1   | 23.2                  | 33.7          | 3.61     | 1.19            | 1.03   |
| Soy bean.....                           | 8.7   | 5.4 | 36.3    | 3.9   | 27.7                  | 18.0          | 5.30     | 1.87            | 1.99   |
| Cowpea.....                             | 11.9  | 3.4 | 23.5    | 3.8   | 55.7                  | 1.7           | 3.12     | 1.01            | 1.20   |
| MILK PRODUCTS.                          |       |     |         |       |                       |               |          |                 |        |
| Corn meal.....                          | 15.0  | 1.4 | 9.2     | 1.9   | 68.7                  | 3.8           | 1.58     | .63             | .40    |
| Corn and cob meal.....                  | 15.1  | 1.5 | 8.5     | 6.6   | 64.8                  | 3.5           | 1.41     | .57             | .47    |
| Oatmeal.....                            | 7.9   | 2.0 | 14.7    | 0.9   | 67.4                  | 7.1           | ..       | ..              | ..     |
| Barley meal.....                        | 11.9  | 2.6 | 10.5    | 6.5   | 66.3                  | 2.2           | 1.55     | .66             | .34    |
| Rye flour.....                          | 13.1  | 0.7 | 6.7     | 0.4   | 78.3                  | 0.8           | 1.68     | .85             | .65    |
| Wheat flour, all analyses.....          | 12.4  | 0.5 | 10.8    | 0.2   | 75.0                  | 1.1           | 1.92     | .57             | .54    |
| Buckwheat flour.....                    | 14.6  | 1.0 | 6.9     | 0.3   | 75.8                  | 1.4           | 1.10     | .52             | .16    |
| Ground corn and oats, equal parts... .. | 13.0  | 2.2 | 10.5    | 5.7   | 64.2                  | 4.4           | 1.57     | .71             | .44    |

TABLE XIII—PERCENTAGE COMPOSITION OF FEEDING STUFFS.—*Concluded.*

| FEEDING STUFF.                        | Water | Ash  | Protein | Fiber | Nitrogen-free extract | Ether extract | Nitrogen | Phosphoric acid | Potash |
|---------------------------------------|-------|------|---------|-------|-----------------------|---------------|----------|-----------------|--------|
| BY-PRODUCTS.                          |       |      |         |       |                       |               |          |                 |        |
| Corn cobs .....                       | 10.7  | 1.4  | 2.4     | 30.1  | 54.9                  | 0.5           | .50      | .06             | .60    |
| Hominy meal .....                     | 11.1  | 2.5  | 9.8     | 3.8   | 64.5                  | 8.3           | 1.63     | .98             | .49    |
| Corn bran .....                       | 8.7   | 1.5  | 9.8     | 11.6  | 62.6                  | 5.8           | 1.63     | 1.01            | .62    |
| Corn-germ meal .....                  | 8.1   | 1.3  | 11.1    | 9.9   | 62.5                  | 7.1           | 1.82     | .39             | .21    |
| Chicago gluten meal .....             | 9.8   | 0.9  | 35.9    | 1.9   | 47.0                  | 4.5           | 5.74     | .34             | .06    |
| Buffalo gluten feed .....             | 8.5   | 2.8  | 26.0    | 6.8   | 52.5                  | 3.4           | 4.16     | 1.15            | .57    |
| Corn and oat feed (44 analyses) ..... | 9.7   | .... | 9.2     | ....  | ....                  | 4.3           | 1.53     | ....            | ....   |
| Oat hulls .....                       | 7.3   | 6.7  | 3.3     | 29.7  | 52.1                  | 1.0           | .54      | .24             | .52    |
| Malt sprouts .....                    | 10.2  | 5.7  | 23.2    | 10.7  | 48.5                  | 1.7           | 3.55     | 1.43            | 1.63   |
| Brewers' grains, wet .....            | 75.7  | 1.0  | 5.4     | 3.8   | 12.5                  | 1.6           | .89      | .31             | .05    |
| Brewers' grains, dried .....          | 8.0   | 3.4  | 24.1    | 13.0  | 44.8                  | 6.7           | 3.62     | 1.03            | .09    |
| Distillery grains, (corn) .....       | 7.0   | 2.0  | 29.2    | 11.0  | 39.4                  | 11.4          | 4.77     | .60             | .17    |
| Distillery grains, (rye) .....        | 6.8   | 2.1  | 17.3    | 12.3  | 54.0                  | 7.5           | 2.83     | .69             | .11    |
| Rye bran .....                        | 11.8  | 3.5  | 14.7    | 3.3   | 63.9                  | 2.8           | 2.32     | 2.28            | 1.40   |
| Wheat bran, all analyses .....        | 11.9  | 5.8  | 15.4    | 9.0   | 53.9                  | 4.0           | 2.67     | 2.89            | 1.61   |
| Wheat bran from winter wheat .....    | 12.3  | 5.9  | 16.0    | 8.1   | 53.7                  | 4.0           | ....     | ....            | ....   |
| Wheat bran from spring wheat .....    | 11.5  | 5.4  | 16.1    | 8.0   | 54.5                  | 4.5           | ....     | ....            | ....   |
| Wheat middlings .....                 | 12.1  | 3.3  | 15.6    | 4.6   | 60.4                  | 4.0           | 2.63     | .95             | .63    |
| Wheat screenings .....                | 11.6  | 2.9  | 12.5    | 4.9   | 65.1                  | 3.0           | ....     | ....            | ....   |
| Buckwheat hulls .....                 | 13.2  | 2.2  | 4.6     | 43.5  | 35.3                  | 1.1           | ....     | ....            | ....   |
| Buckwheat bran .....                  | 10.5  | 3.0  | 12.4    | 31.9  | 38.8                  | 3.3           | 1.94     | 1.77            | 0.93   |
| Buckwheat middlings .....             | 13.2  | 4.8  | 28.9    | 4.1   | 41.9                  | 7.1           | 4.88     | 2.60            | 1.33   |
| Cotton-seed hulls .....               | 11.1  | 2.8  | 4.2     | 46.3  | 33.4                  | 2.2           | .69      | .25             | 1.02   |
| Cotton-seed feed .....                | 8.0   | 3.7  | 13.4    | 32.5  | 38.7                  | 3.7           | ....     | ....            | ....   |
| Cotton-seed meal .....                | 8.2   | 7.2  | 42.3    | 5.6   | 23.6                  | 13.1          | 6.79     | 2.88            | .87    |
| Linseed meal, old process .....       | 9.2   | 5.7  | 32.9    | 8.9   | 35.4                  | 7.9           | 5.43     | 1.66            | 1.37   |
| Linseed meal, new process .....       | 9.9   | 5.6  | 35.9    | 8.8   | 36.8                  | 3.0           | 5.78     | 1.83            | 1.39   |
| Sugar-beet pulp, fresh .....          | 89.9  | 0.4  | 1.0     | 2.2   | 6.3                   | 0.2           | .16      | .02             | .34    |
| Sugar-beet pulp, dry .....            | 6.4   | 3.3  | 10.8    | 19.8  | 58.4                  | 1.3           | 1.54     | .15             | 1.81   |
| Tankage ("8 and 25") .....            | 6.3   | 12.9 | 42.2    | 6.9   | 15.5                  | 16.3          | 6.75     | 11.8            | ....   |
| Dried blood .....                     | 7.9   | 3.2  | 70.6    | 1.2   | 16.6                  | 0.5           | 11.29    | 1.2             | .70    |
| Bone meal .....                       | 7.5   | .... | 25.0    | ....  | ....                  | 1.7           | 4.00     | 23.0            | .10    |
| Fresh bone .....                      | 34.2  | 22.8 | 20.6    | ....  | 1.9                   | 20.5          | ....     | ....            | ....   |
| Boiled beef bone .....                | 5.7   | .... | 44.8    | ....  | ....                  | 17.1          | ....     | ....            | ....   |
| MILK AND ITS BY-PRODUCTS.             |       |      |         |       |                       |               |          |                 |        |
| Whole milk .....                      | 87.2  | 0.7  | 3.6     | ....  | 4.9                   | 3.7           | .57      | .19             | .18    |
| Skim milk, gravity .....              | 90.4  | 0.7  | 3.3     | ....  | 4.7                   | 0.9           | .53      | .20             | .19    |
| Skim milk, separator .....            | 90.6  | 0.7  | 3.2     | ....  | 5.2                   | 0.3           | ....     | ....            | ....   |
| Whey .....                            | 93.8  | 0.4  | 0.9     | ....  | 5.1                   | 0.1           | .15      | .14             | .18    |

TABLE XIII—PERCENTAGE COMPOSITION OF FEEDING STUFFS.—*Concluded.*

| FEEDING STUFF.              | Water | Ash | Protein | Fiber | Nitrogen-free extract | Ether extract | Nitrogen | Phosphoric acid | Potash |
|-----------------------------|-------|-----|---------|-------|-----------------------|---------------|----------|-----------------|--------|
| MISCELLANEOUS.              |       |     |         |       |                       |               |          |                 |        |
| Acorns . . . . .            | 55.3  | 1.0 | 2.5     | 4.4   | 34.8                  | 1.9           | 40       | .15             | .63    |
| Apples . . . . .            | 80.8  | 0.4 | 0.7     | 1.2   | 16.6                  | 0.4           | 13       | .01             | .19    |
| Cabbage . . . . .           | 90.5  | 1.4 | 2.4     | 1.5   | 3.9                   | 0.4           | .38      | .11             | .43    |
| Pumpkin (field) . . . . .   | 90.9  | 0.5 | 1.3     | 1.7   | 5.2                   | 0.4           | 11       | .16             | .09    |
| Sugar beet leaves . . . . . | 88.0  | 2.4 | 2.6     | 2.2   | 4.4                   | 0.4           | ....     | ....            | ....   |

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